PROGRAM SUBMITTAL

☒ New Program ☐ Revision to Program

Model No. ☐ 67 ☐ 97 ☒ 41C

Program Title MESSIER OBJECT SEARCH

No. of Steps/Lines 226 Category No. 510

Category Name ASTRONOMY

Abstract — 50 Word Maximum This program will identify the type and coordinates of all Messier objects within a user-specified area of the evening sky. This will aid the astronomer in performing an orderly search of all Messier objects. It also doubles as a ready reference of the coordinates for a desired M. object.

Necessary Accessories: Quad or two single density memory modules. Printer optional.

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Company

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If my program is accepted, my bonus choice is: (Please select two programs if your program is a revision.)

Acceptance Choice: ☐ FOUR PROGRAMS, ☒ CREDIT FOR FOUR PROGRAMS*, OR TWO PROGRAMS AND 10 BLANK CARDS.

* No partial credit will be given. Select all four programs at the same time.

Submittal Checklist: Please use the checklist below to insure submittal of all proper program documentation.

☐ Program Submittal ☐ Program Description II ☐ Program Listing(s) ☐ Registers, Status ...

☐ Program Description I ☐ User Instructions ☐ Magnetic Card(s) ☐ Keyboard, Card Labeling (optional)

ACKNOWLEDGMENT AND AGREEMENT

To the best of my knowledge, I have the right to contribute this program material without breaching any obligation concerning nondisclosure of proprietary or confidential information of other persons or organizations. I am contributing this program material on a nonconfidential nonobligatory basis to Hewlett-Packard Company ("HP") for inclusion in its program library, and I agree that HP may use, duplicate, modify, publish, and sell the program material, and authorize others to do so without obligation or liability of any kind. HP may publish my name and address, as the contributor, to facilitate user inquiries pertaining to this program material.

Signature Gerard Maynard Date Oct 17, 1981

PROGRAM DESCRIPTION I

Program Title MESSIER OBJECT SEARCH

Contributor's Name GERARD MAYNARD

Address 850 PANORAMA 1B

City PALATINE **State/Country** IL. **Zip Code** 60067

Program Description, Equations, Variables This program allows the user to obtain the coordinates of all Messier objects in a user-specified portion of the celestial sphere, making possible the locating of these objects in an astronomical telescope without the aid of charts or coordinate references. The type of object is also given; Open Cluster, Globular Cluster, Galaxy, Gas Nebula or Planetary Nebula. The search may also be conducted for only one of these object types.

The program will also provide the user with the coordinates of a user-specified Messier object.

The search is conducted along the Right Ascension axis. The speed of the complete search depends on the Range given by the user. Too large a range of R.A. will locate many objects, which requires

Necessary Accessories Quad or two single density memory modules, printer optional

Operating Limits and Warnings Any operation which will alter the storage registers will eliminate that data and result in erroneous output.

Reference(s) "Norton's Star Atlas and Reference Handbook", 16th edition by Arthur P. Norton, Sky Publishing Corporation 1973

PROGRAM DESCRIPTION I

Program Title

Contributor's Name

Address

City State/Country Zip Code

Program Description, Equations, Variables

large adjustment of the telescope. An orderly search is conducted over a small range, which in most of the sky is plus-or-minus one-half hour. This range is inserted by the program if the user doesn't insert a different range.

The coordinates of each object are contained in one register. The integer identifies the type of object, the first five digits to the right of the decimal point are the Right Ascension and the last four digits are the declination. The sign of the number (+ or -) determines the sign of the Declination angle. The register address is used to identify the M. #. (note: the R.A. coordinate stored has been converted to decimal hours)

Necessary Accessories

Operating Limits and Warnings

Reference(s)

PROGRAM DESCRIPTION II

Sample Problem (Sketch if Desired)

1. Identify any objects from R.A. 19.5 to 20.5 hours

2. Identify all Gas Nebula's in the Messier Catalog

3. Identify type and coordinates of M. 31

SOLUTION:

	Input	Function	Display	Comments
1.		XEQ "MESSIER"		
			CHOOSE TYPE: OPEN CLUSTER GLOB CLUSTER GALAXY GAS NEBULA PLN NEBULA ALL TYPES	display the object choices
	N	ENTER key		"ALL TYPES" of objects are chosen. Enter key pressed while ALPHA annunciator is in the display
			R.A.: HH.MM?	
	20	R/S	RANGE: HH ?	Right Ascension entered
	.5	R/S	M.27 PLN NEB R.A. 19.57.5 DEC. 22.35	Range entered note: if the range desired is .5, only R/S need be pressed
			M.29 OPEN CL R.A. 20.22.1 DEC. 38.22	
			M.55 GLOB CL R.A. 19.37.3 DEC. -31.03	
			M.71 GLOB CL R.A. 19.51.5 DEC. 18.39	
			M.75 GLOB CL R.A. 20.03.2 DEC. -22.04	

(CONTINUATION PAGE)

	input	function	display	comments
2.		XEQ"MESSIER"		
			CHOOSE TYPE:	
			OPEN CLUSTER	
			GLOB CLUSTER	
			GALAXY	
			GAS NEBULA	
	N	ENTER key		"GAS NEBULA" type chosen
			R.A.:HH.MM?	(note flag 3 set for type)
	12	R/S		R.A. entered
			RANGE: HH. ?	
	12	R/S		12 +/- 12 = 0 through 24
			M.1 GAS NEB R.A. 5.31.5 DEC. 21.59	
			M.8 GAS NEB R.A. 18.01.1 DEC. -24.23	
			M.17 GAS NEB R.A. 18.18.3 DEC. -16.12	
			M.20 GAS NEB R.A. 17.59.6 DEC. -23.02	
			M.42 GAS NEB R.A. 5.33.3 DEC. -5.25	
			M.43 GAS NEB R.A. 5.33.1 DEC. -5.18	
			M.78 GAS NEB R.A. 5.44.2 DEC. 0.02	
3.	USER LOG 31	XEQ "D" R/S	ENTER M.	
			M.31 GALAXY R.A. 0.39.6 DEC. 41.00	

USER INSTRUCTIONS

SIZE: (HP-41C) 113

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	XEQ "SIZE" 113			
2	Load the program and data cards			
3	Execute the program, press		XEQ "MESSIER"	
4	Choose the type of object to be searched for by pressing (the ENTER key must be pressed while the ALPHA annun. is on)	N	"ENTER"	
5	HP-41 prompts for Right Ascension Enter the R.A. coordinate as HH (hour) . MM (minute)	hh.mm	R/S	R.A.: HH.MM?
6	HP-41 prompts for Range Enter the range on each side of the R.A. as HH (hour)	hh	R/S	RANGE: HH?
7	Step through the display		R/S	
8	The search ends after all registers are examined			DONE
9	To repeat the search, changing only the R.A. and RANGE, press		[USER] LN	
	0 R (after steps 1-3)			
4	In USER mode, press		LOG	
5	HP-41 prompts for M. number			ENTER M.
6	The type and coordinates are displayed			

PROGRAM LISTING

☐ 67 ☐ 97 ☒ 41C

STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
01	*LBL "MES		
	SIER"		
02	CF 21		
03	"CHOOSE		
	TYPE"		
04	AVIEW		
05	PSE		
06	CF 00		
07	CF 01		Clear flags
08	CF 02		
09	CF 03		
10	CF 04		
11	CF 05		
12	CF 06		
13	SF 12		
14	CF 23		
15	.005		
16	STO 01		
17	AON		
18	*LBL 01		
19	"OPEN CL		Begin choice of object type
	USTER"		
20	0		
21	XEQ 15		
22	"GLOB CL		
	USTER"		
23	1		
24	XEQ 15		
25	" GALA		
	XY"		
26	2		
27	XEQ 15		
28	" GAS NE		
	BULA"		
29	3		
30	XEQ 15		
31	" PLN NE		
	BULA"		
32	4		
33	XEQ 15		
34	" ALL TY		
	PES"		
35	5		
36	XEQ 15		
37	GTO 01		
38	*LBL 15		Subroutine for choosing object type
39	AVIEW		
40	PSE		
41	FC? 23		
42	RTN		
43	SF IND X		
44	5		
45	X≠Y?		
46	GTO 14		
47	SF 00		Set flag to identify object type for duration of search
48	SF 01		
49	SF 02		
50	SF 03		
51	SF 04		
52	*LBL 14		
53	AOFF		
54	FC? IND		
	01		
55	GTO 03		Generate and store type identification digit
56	RCL 01		
57	INT		
58	1		
59	+		
60	STO 03		
61	*LBL 03		
62	ISG 01		
63	GTO 14		
64	*LBL E		
65	CF 21		
66	"R.A.: H		
	H.MM?"		
67	PROMPT		
68	1 E2		Store Right Asc. coordinate
69	/		
70	STO 00		
71	CF 22		
72	"RANGE:		
	HH ?"		
73	PROMPT		Store Range for the search. If no data, store .5 hr as the range
74	FC? 22		
75	.5		
76	1 E2		
77	/		
78	STO 02		
79	3.112		Control number
80	STO 01		
81	*LBL 02		
82	ISG 01		Start of search loop
83	GTO 03		
84	GTO 07		
85	*LBL 03		
86	RCL IND		
	01		

Note: Refer to "HP-41C OWNER'S HANDBOOK AND PROGRAMMING GUIDE" for specific information on keystrokes. The Function Index is found at the very back of the Handbook. Refer to Appendix E in 67 or 97 "OWNER'S HANDBOOK AND PROGRAMMING GUIDE" for exact keystrokes.

PROGRAM LISTING

☐ 67 ☐ 97 ☒ 41C

STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
87	ABS		If blank register
88	X=0?		continue loop
89	GTO 02		
90	INT		
91	RCL 03		
92	6		If "All Types",
93	X=Y?		go to position
94	GTO 03		test
95	RDN		
96	X≠Y?		If wrong type,
97	GTO 02		index and repeat
98	*LBL 03		
99	.24		Position test
100	RCL 00		
101	RCL 02		
102	+		
103	X<Y?		R.A. + Range
104	GTO 04		greater than 24
105	X<>Y		hours
106	-		
107	RCL IND 01		
108	FRC		
109	ABS		
110	X<Y?		
111	GTO 06		
112	*LBL 04		
113	RCL 00		
114	RCL 02		
115	-		
116	0		R.A. - Range
117	X<Y?		less than 0 hr
118	GTO 05		
119	RDN		
120	.24		
121	+		
122	RCL IND 01		
123	FRC		
124	ABS		
125	X>Y?		
126	GTO 06		R.A. - object RA
127	*LBL 05		calculation. If
128	RCL 00		greater than
129	RCL IND 01		Range, continue
130	FRC		loop. If less
131	ABS		than range, go
132	-		to display
133	ABS		
134	RCL 02		
135	X<Y?		
136	GTO 02		
137	*LBL 06		
138	TONE 5		Indicates object
139	SF 21		found
140	CF 29		
141	"M."		
142	RCL 01		
143	3		Calculate M. #
144	-		
145	FIX 0		
146	ARCL X		
147	SF 29		
148	RCL IND 01		
149	ABS		
150	7		
151	+		
152	GTO IND X		
153	*LBL 08		
154	"⊢ OPEN CL"		
155	GTO 13		Add object type
156	*LBL 09		to M. # for
157	"⊢ GLOB CL"		display
158	GTO 13		
159	*LBL 10		
160	"⊢ GALAX Y"		
161	GTO 13		
162	*LBL 11		
163	"⊢ GAS NEB"		
164	GTO 13		
165	*LBL 12		
166	"⊢ PLN NEB"		
167	*LBL 13		Display
168	AVIEW		
169	"R.A. "		
170	RCL IND 01		
171	FRC		
172	ABS		
173	1 E2		

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PROGRAM LISTING

☐ 67 ☐ 97 ☒ 41C

STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
174	*		
175	HMS		Calculate Right
176	10		Ascension of
177	*		object
178	INT		
179	10		
180	/		
181	FIX 1		
182	ARCL X		
183	RCL IND 01		
184	FRC		
185	ABS		
186	1 E2		
187	*		
188	HMS		
189	10		
190	*		
191	FRC		
192	10		
193	*		
194	ARCL X		
195	AVIEW		Display
196	"DEC. "		
197	RCL IND 01		
198	1 E5		Calculate Dec-
199	*		lination of object
200	FRC		
201	1 E2		
202	*		
203	FIX 2		
204	ARCL X		
205	AVIEW		Display
206	FS? 55		
207	ADV		
208	CLA		
209	FC? 06		
210	GTO 02		Continue the loop
211	GTO D		
212	*LBL 07		
213	TONE 0		Indicates end of
214	CF 21		search
215	" DONE"		
216	PROMPT		
217	GTO E		
218	*LBL D		Routine for obtaining
219	SF 06		the coordinates and type of known M. #
220	"ENTER M."		
221	PROMPT		
222	3		Generate register
223	+		address
224	STO 01		
225	GTO 06		Go to display
226	END		

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REGISTERS, STATUS, FLAGS, ASSIGNMENTS

DATA REGISTERS

R00= scratch	R48= 1.037472357	R96= -1.077132345
R01= "	R49= -1.076661442	R97= 3.128164123
R02= "	R50= -1.075751422	R98= 3.106911158
R03= "	R51= -1.081910538	R99= 3.107381205
R04= 4.055302159	R52= 3.124500816	R100= 5.112085518
R05= -2.215250103	R53= -1.070160816	R101= 3.121911511
R06= 2.136752838	R54= 3.134724727	R102= 3.122751442
R07= -2.163502624	R55= 1.233666119	R103= 3.123441606
R08= 2.152680216	R56= 2.131001826	R104= 3.140275435
R09= -1.176193211	R57= -2.188663032	R105= 3.140275435
R10= -1.178503448	R58= -2.196253103	R106= 1.014996026
R11= -4.180192423	R59= 2.192503005	R107= -3.126251121
R12= -2.172721028	R60= 5.188723258	R108= 3.107551251
R13= -2.169130402	R61= 3.125861205	R109= 3.122804735
R14= -1.188110620	R62= 3.126631155	R110= -2.165021257
R15= -2.167500152	R63= 3.126861149	R111= 3.111525557
R16= 2.166753633	R64= 3.123270445	R112= 3.119165339
R17= -2.175830313	R65= -2.169693003	
R18= 2.214661157	R66= 3.132304217	
R19= -1.182661348	R67= 3.129082157	
R20= -4.183081612	R68= 3.112751323	
R21= -1.182831709	R69= 3.113001317	
R22= -2.169972611	R70= 1.088131200	
R23= -4.179992302	R71= -2.126222629	
R24= -1.180332230	R72= -2.184693223	
R25= -2.185582358	R73= -2.186663221	
R26= -1.179081901	R74= 2.198631839	
R27= -1.182331830	R75= -2.208521244	
R28= -1.184881917	R76= -1.209381250	
R29= -1.187130927	R77= 3.015661532	
R30= 5.199632235	R78= -2.200552204	
R31= -2.183632454	R79= 5.016525119	
R32= 1.203693822	R80= -3.026690014	
R33= -2.216302325	R81= 4.057380002	
R34= 3.006664100	R82= -2.053722434	
R35= 3.006664036	R83= -2.162362252	
R36= 3.015193024	R84= 3.098636918	
R37= 1.026554234	R85= 3.098756956	
R38= 1.061052421	R86= -3.135752937	
R39= 1.055553406	R87= 3.123831310	
R40= 1.058193232	R88= 3.123881828	
R41= 1.054253548	R89= 3.124021313	
R42= 1.215114813	R90= 3.124751240	
R43= 0.000000000	R91= 3.124971442	
R44= -1.067582041	R92= 3.125521250	
R45= -4.055580525	R93= 3.125751326	
R46= -4.055520518	R94= 0.000000000	
R47= 1.986222010	R95= 2.172664312	

STATUS

SIZE 113 TOT. REG. 188 USER MODE

ENG FIX SCI ON X OFF

DEG RAD GRAD

FLAGS

#	INIT S/C	SET INDICATES	CLEAR INDICATES
00	C	OPEN CLUSTER	not this type
01	C	GLOBULAR CLUSTER	"
02	C	GALAXY	"
03	C	GAS NEBULA	"
04	C	PLANETARY NEBULA	"
05	C	ALL TYPES	not all types
06	C	specific M. #	search loop
21	C	printing	no printing
22	C	numeric input	no input
23	C	alpha input	no input

ASSIGNMENTS

FUNCTION	KEY	FUNCTION	KEY